1,149,722

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in and relating to Tyre Building Apparatus

We, THE DUNLOP COMPANY LIMITED (formerly Dunlop Rubber Company Limited), a British Company, of Dunlop House, Ryder Street, St. James, London, S.W.1. (formerly of 1, Albany Street, London, N.W.1.), do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to tyre building method and apparatus, and particularly, to the transference of, by means of a transfer device, an annular tyre component of a pneumatic tyre to the carcass during the building of the tyre. Such a component may comprise either the tread portion, one or more breaker layers or both the tread portion and breaker layer or layers together and such tyre components will hereinafter be referred to as being "of the type specified."

This invention is also a modification of the method and apparatus described and claimed in our co-pending Application No. 25303/66 (Serial No. 1149723) dated 7th June 1966, for the assembly of a breaker element upon a carcass.

According to one aspect of the invention there is provided a method of assembling an annular tyre component of the type specified upon the carcass of a pneumatic tyre comprising expanding the component radially outwardly to an internal diameter which is greater than the maximum external diameter of the carcass, maintaining the component in its expanded condition in engagement with a transfer device and positioning it co-axially about the carcass and deforming the component radially inwardly whilst still in engagement with the device to bring circumferentially spaced-apart regions of its radially-inner surface into contact with the radially-outer surface of the carcass.

Preferably a source of suction is applied to the radially outer surface of the component after it has been expanded radially outwardly to maintain it in its expanded condition whilst it is being positioned abut the carcass and the source of suction is only released after the component has been deformed radially inwardly and after said regions of the radially-inner surface thereof have been brought into contact with the carcass.

Also in a preferred example of the above method pressure is applied to the radially-outer surface of the component at a plurality of positions spaced apart circumferentially thereof to deform the component radially inwardly.

In the above method it is preferred that the component is initially located co-axially about a radially-deformable annular member, said member being deformed radially outwardly to bring the component into its expanded condition and said member being deformed radially inwardly to withdraw it radially from the expanded component whilst the component is maintained in its expanded condition. The radially-deformable annular member conveniently comprises a inflatable member and a source of compressed fluid is supplied to it to deform it radially outwards.

According to a further aspect of the invention there is provided a transfer device for applying an annular tyre component of the type specified to a carcass of a pneumatic tyre comprising a transfer ring having a radially inner surface, the diameter of which is greater than the maximum external diameter of the carcass and applied component, securing means associated with the transfer ring operable to maintain the component in a radially-outwardly-expanded condition coaxially within said ring and release means associated with said ring operable to press circumferentially spaced apart regions of the radially-inner surface of the component into contact with the radially-outer surface of the carcass.

In one example of the above device the securing means comprises an annular suction chamber located around the radially-inner periphery of the transfer ring, said chamber

being connectable to a source of suction, and the release means comprises a plurality of release members circumferentially spaced apart around the periphery of the ring, each such member comprising the piston of a fluid-pressure-operated piston and cylinder assembly and each piston being moveable radially inwardly of the radially-inner surface of the transfer ring to press the expanded component on to the carcass.

The transfer device may also include an annular expansion device, about which the transfer ring is coaxially locatable, for expanding the component to its expanded condition within the transfer ring, the expansion device conveniently comprising an annular inflatable tube connectable to a source of compressed fluid. It is preferred that the transfer ring and the expansion device are co-axially locatable with the carcass, the ring being axially movable between the expansion device and the carcass.

Also in accordance with the invention there is provided a pneumatic tyre wherein an annular tyre component of the type specified has been assembled upon the carcass by the method described above or by use of the apparatus described above.

One embodiment of the method and apparatus for assembling a tread band onto the carcass of a pneumatic tyre during the building of the tyre will now be described in more detail with reference to the accompanying drawings wherein:

Figure 1 is an axial cross-sectional view of the transfer ring and expansion device showing the tread band in position before it is expanded,

Figure 2 is a radial cross-sectional view perpendicular to the axis of that part of the apparatus shown in Figure 1,

Figure 3 is an axial cross-sectional view showing the expanded tread band within the transfer ring and positioned co-axially about the carcass,

Figure 4 is an axial cross-section view similar to Figure 3 but showing the tread band being pressed radially inwardly into contact with the carcass, and

Figure 5 is a radial elevation perpendicular to the axis of that part of the apparatus shown in Figure 4.

Referring first of all to Figures 1 and 2 of the drawings there is shown a transfer device comprising a transfer ring 10 within which an annular tread band 11 is transferred from an expansion device 12 to the carcass 13 (see Figures 3 and 4) of a pneumatic tyre. The transfer ring 10 is of annular form having a cylindrical radially inner surface 14 and radially inwardly projecting lips 15 formed at the axially outer edges of said surface 14 for gripping the tread band.

At equally-spaced-apart positions circumferentially of the ring 10 there is provided a plurality of release members each one of which comprises a fluid-pressure operated piston 16 and cylinder 17 mounted upon the radially outer surface of the ring. The piston 16 of each such assembly is moveable radially of the ring in such a manner that the head 18 of the piston can project radially inwardly of the radially inner surface 14 of the ring and of the lips 15. Each such assembly is double acting and is provided with a first pipe 19 for connection to a source of compressed air for causing radially inward movement of the piston 16 and a second pipe 20 also connected to a source of compressed air for causing radial outward movement of the piston. The two pipes 19 and 20 of each such assembly are connected to common supply pipes 21 and 22 respectively extending circumferentially around the transfer ring.

In addition to the radially inwardly projecting lips 15 of the transfer ring there are also provided two radially outwardly extending flanges 23 one of which is secured to a web 24 having two collars 25 formed thereon through each of which pass shafts 26. The collars 25 are mounted for sliding movement upon their shafts 26 in such a manner that the whole transfer ring assembly may slide axially between the expansion device 12 and the carcass 13 of the tyre. The transfer ring 10 is retained with its mid-circumferential plane *z—z* co-incident with the mid-circumferential plane of the expansion device by means of a pivotally-mounted pawl 27 engaged within a correspondingly-shaped recess in a projection 25*a* formed on one of the collars 25.

The expansion device 12 comprises a plurality of circumferentially-separated segments 28 defining a cylindrical radially-outer surface upon wich is located an annular bend 29 of elastomeric material such as rubber. Radially-inwardly-projecting abutment flanges 30 are provided at the axially-outer edges of the segments which bear, in the position shown in Figure 1, upon the radially-outer cylindrical surfaces of annular support members 31.

The support members 31 are axially separated and each one is formed with an integral annular radially-inwardly-projecting flange 32 at its axially-inner edge, the two flanges 32, and hence the support members 31, being secured together, by means of a plurality of bolts 33.

Each segment 28 has a radially-inwardly-projecting guide member 34 secured thereto by a bolt 35, the head 36 of which projects outwardly of the radially-outer surface of the segment and engages within a corresponding recess formed in the band 29 thereby preventing axial displacement of the band relative to the segments. The guide members 34 of the sements are radially slidable within corresponding grooves defined between the flanges 32 of the support members 31.

Hence the segments 28 themselves are

radially displaceable relative to the support members 31, their radially outward movement being limited by a stop 37 on each guide 34 and their radially inward movement being limited by the abutment flanges 30 and being brought about by the resilience of the band 29.

One of the radially-inwardly-projecting flanges 32 of the support members 31 is secured to a collar 38 fixedly mounted upon a shaft 39 by means of which the expansion device 12 may be rotated and the longitudinal axis *x*—*y* of this shaft 39 is co-axial with that of the transfer ring 10.

Two annular inflatable tubes 40 are located between the radially outer surfaces of the support members 31 and the radially inner surfaces of the segments 28 each tube being connectable to a compressed air source via a pipe 41 formed in the radially inner surface of each tube. Connection of each tube 40 to a source of compressed air causes inflation of the tubes thereby causing radially outward movement of the segments 28. Thus the segments may be retained in a radially-outwardly-expanded condition as shown in dotted lines in Figure 1 by the supply of compressed air to the inflatable tubes 40 whilst connection of the tubes to atmosphere will result in radially-inward movement of the segments 28 under the elastic influence of the band 29 situated around the radially-outer surface of the segments.

Figures 3, 4 and 5 show the transfer ring 10 with the tread band 11 contained within it located symmetrically about the carcass 13 of a pneumatic tyre. The carcass is shown in its partially shaped condition mounted upon the diaphragm of a suitable form of tyre building former 42. The transfer ring is retained in position with its mid-circumferential plane *z*—*z* co-incident with the mid-circumferential plane of the carcass 13 by means of a further pawl 43 engaged within the aforesaid recess in the projection 25*a* formed on one of the collars 25.

In use of the above apparatus a tread band 11 in annular form is first of all located symmetrically about the radially outer surface of the rubber band 29 of the expansion device 12 (see Figure 1). The transfer ring 10 is then located symmetrically about the expansion device and compressed air is supplied to the pipe 22 to cause all of the pistons 16 of the piston and cylinder assemblies to move to their radially outermost positions wherein the radially - innermost extremities of the heads 18 of the pistons are at a position, in the radial sense, co-incident with the cylinder defined by the radially-innermost extremities of the radially-inwardly-projecting lips 15 of the ring.

Compressed air is then admitted to the inflatable tubes 40 of the expansion device to move the segments 28 and the rubber band 29 radially outwardly, thereby extending the tread band 11 until its radially-outer surface comes into contact with the lips 15 (this position is shown in dotted lines in Figure 1). A source of suction is then connected to a pipe 44 which extends radially through the transfer ring thereby creating a partial vacuum within the suction chamber 45 defined between the radially-inner surface 14 of the ring, the axially-inner surfaces of the lips 15 and the radially-outer surface of the tread band 11. The inflatable tubes 40 are then connected to atmosphere so that the rubber band 29 and segments 28 of the expansion device are withdrawn radially inwardly away from the radially inner surface of the tread band 11 whilst the tread band is maintained in its expanded position due to the partial vacuum in the aforesaid annular section chamber 45.

The pawl 27 is then released and the transfer ring 10 is slid axially towards the carcass 13 until the other pawl 43 engages with the collar 25. Compressed air is then admitted to the cylinders 17 via the supply pipe 21 to cause the pistons 16 to move radially inwardly, thereby pressing the radially-inner surface of the tread band 11 into contact with the radially-outer surface of the carcass 13 at a plurality of circumferentially-spaced-apart positions 46 (this step is shown in Figures 4 and 5 of the drawings). After the tread band has been pressed into firm contact with the carcass the annular suction chamber 45 is connected to atmosphere and it should be noted that the source of suction is not released until after the tread band has been pressed firmly into contact with the carcass, whereby no axial displacement of the band relative to the carcass is possible.

The axially-outer edges of the tread band are then removed from engagement with the lips 15 of the transfer ring and applied to the carcass, this operation being facilitated since the tread band has been expanded before being transferred to the carcass, whereby it tends to resume, because of its inherent elasticity, a smaller diameter when it is released from the transistor ring.

It will be appreciated that, although the foregoing description relates to the assembly of an annular tyre component, comprising a tread band, upon a carcass, the apparatus and method described may equally advantageously be utilised for the assembly of one or more breaker layers, or a tread band and breaker layer or layers together, upon a carcass.

WHAT WE CLAIM IS:—

1. A method of assembling an annular tyre component of the type specified upon the carcass of a pneumatic tyre comprising expanding the component radially outwardly to an internal diameter which is greater than the maximum external diameter of the carcass, maintaining the component in its expanded condition in engagement with a triangle device and positioning it co-axially about the carcass and

deforming the component radially inwardly whilst still in engagement with the device to bring circumferentially spaced-apart regions of its radially-inner surface into contact with the radially-outer surface of the carcass.

2. A method according to claim 1 wherein a source of suction is applied to the radially-outer surface of the component, after it has been expanded radially outwardly, to maintain it in its expanded condition whilst it is being positioned about the carcass.

3. A method according to claim 2 wherein the source of suction is released after the component has been deformed radially inwardly and after said regions of the radially-inner surface thereof have been brought into contact with the carcass.

4. A method according to any one of claims 1 to 3 wherein pressure is applied to the radially-outer surface of the component to deform the component radially inwardly.

5. A method according to claim 4 wherein said pressure is applied to the radially-outer surface of the component at a plurality of positions spaced apart circumferentially thereof.

6. A method according to any one of the preceding claims wherein the component is initially located co-axially about a radially-deformable annular member, said member is deformed radially outwardly to bring the component into its expanded condition and said member is deformed radially inwardly to withdraw it radially from the expanded component whilst the component is maintained in its expanded condition.

7. A method according to claim 6 wherein said member comprises an inflatable member and a source of compressed fluid is supplied to it to deform it radially outwardly.

8. A transfer device for transferring an annular tyre component of the type specified onto a carcass of a pneumatic tyre comprising a transfer ring having a radially-inner surface, the diameter of which is greater than the maximum external diameter of the carcass and applied component, securing means associated with the transfer ring operable to maintain the component in a radially outwardly expanded condition coaxially within said ring and release means associated with said ring operable to press circumferentially spaced-apart regions of the radially-inner surface of the component into contact with the radially-outer surface of the carcass.

9. A transfer device as claimed in claim 8 wherein the securing means comprises an annular suction chamber located around the radially-inner periphery of the transfer ring, said chamber being connectable to a source of suction.

10. A transfer device as claimed in claim 9 wherein the suction chamber comprises an annular base and two radially-inwardly extending axially-spaced-apart annular sealing members projecting therefrom.

11. A transfer device as claimed in either one of claims 8 or 9 wherein the release means comprises a plurality of release members circumferentially-spaced-apart of the periphery of the ring, each member being movable radially inwardly of the radially-inner surface of the ring to press the expanded component into the carcass.

12. A transfer device as claimed in claim 11 wherein each release member comprises the piston of a fluid-pressure-operated piston and cylinder assembly.

13. A transfer device as claimed in any one of claims 8 to 12 including an annular expansion device, about which the transfer ring is co-axially locatable, for expanding the component to its expanded condition within the transfer ring.

14. A transfer device as claimed in claim 13 wherein the expansion device comprises an annular radially-deformable member.

15. A transfer device as claimed in claim 14 wherein said annular radially-deformable member comprises an inflatable tube connectable to a source of compressed fluid.

16. A transfer device as claimed in any one of claims 13 to 15 wherein the transfer ring and the expansion device are co-axially locatable with the carcass and the transfer ring is axially movable between said device and the carcass.

17. A transfer device constructed and arranged substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

18. A pneumatic tyre wherein an annular tyre component of the type specified has been assembled upon the carcass by the method as claimed in any one of claims 1 to 7.

19. A pneumatic tyre wherein an annular tyre component of the type specified has been assembled upon the carcass by use of the apparatus as claimed in any one of claims 8 to 17.

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Agent for the Applicants.

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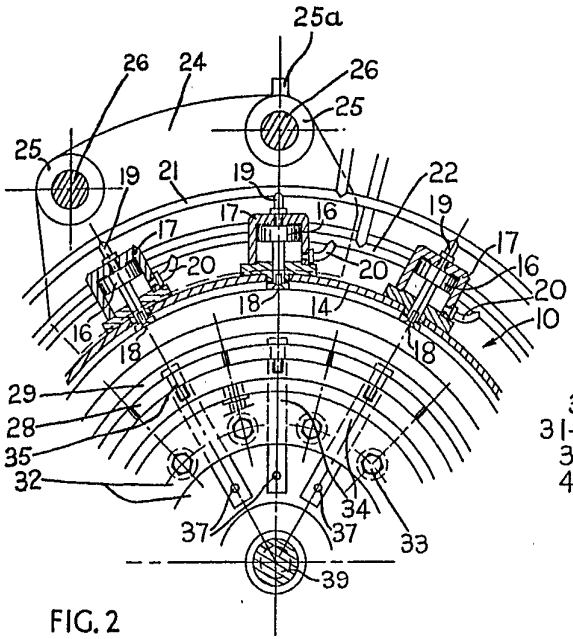
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FIG. 2

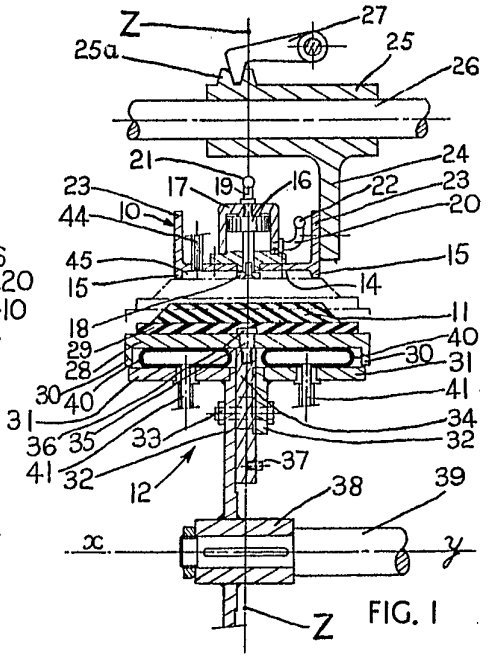
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FIG. 1

1149722 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheets 1 & 2

FIG. 1

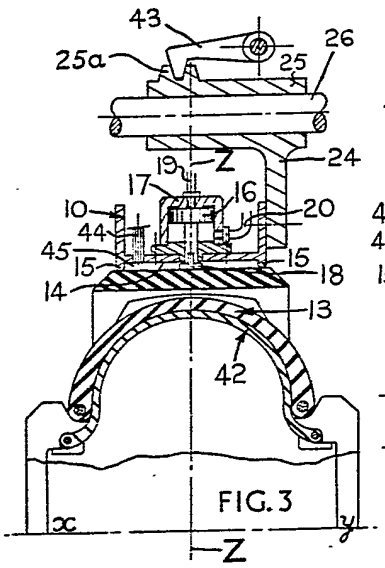

FIG. 3

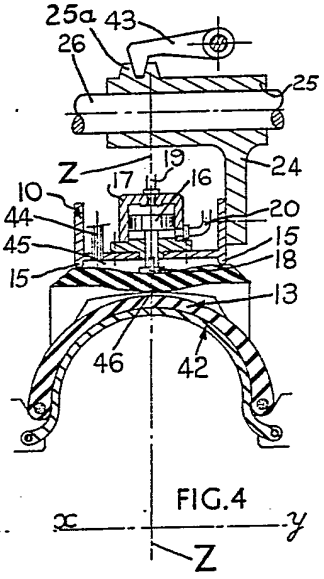

FIG. 4

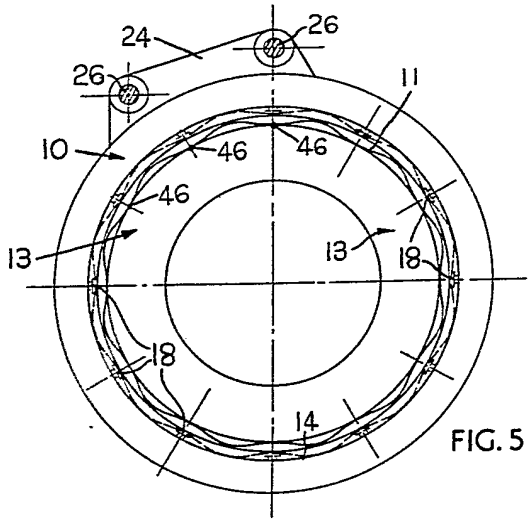

FIG. 5

FIG. 2

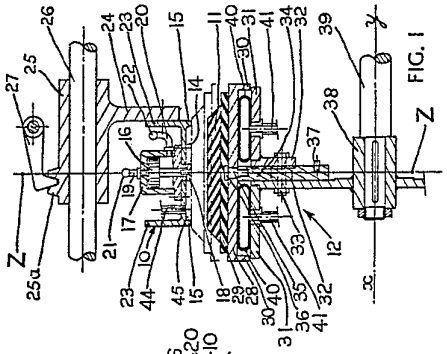

FIG. 1

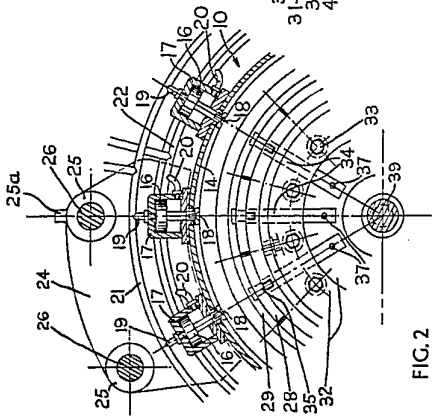

FIG. 2

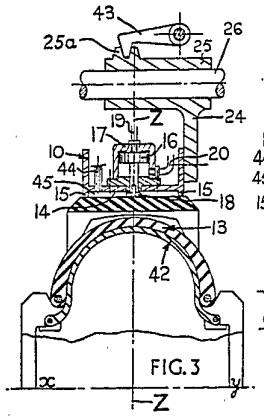

FIG. 3

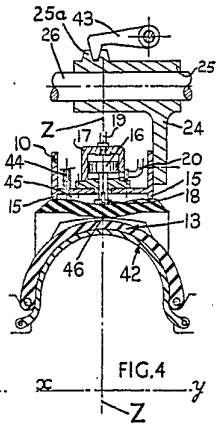

FIG. 4

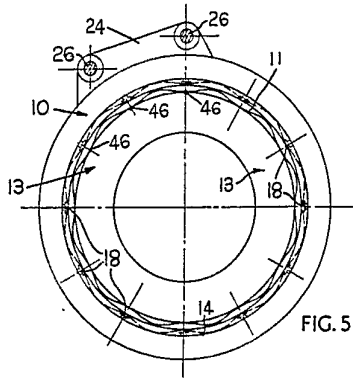

FIG. 5